Supplementary Information: charge regulation of nonpolar colloids

James E. Hallett,[1,2] David A. J. Gillespie,[1] Robert M. Richardson,[2] and Paul Bartlett[1]

[1)] *School of Chemistry, University of Bristol, Bristol BS8 1TS, UK.*

[2)] *School of Physics, University of Bristol, Bristol BS8 1TL, UK.*

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I. IONIC-MONOMER MODIFIED NP3 NANOPARTICLES

Nanoparticles NP3 were synthesised by a dispersion copolymerization of methyl methacrylate, methacrylic acid, and the ionic monomer *n*-tridodecyl-propyl-3-methacryloyloxy ammonium tetrakis [3,5-bis (trifluoromethyl) phenyl] borate ($[\mathrm{ILM-(C_{12})}]^{+}[\mathrm{TFPB}]^{-}$) in weight ratios p:q:r of 4:98:2. The molecular structure of the resulting copolymer is illustrated in Figure 1 where the positive quaternary ammonium ions are covalently bound within the core of the nanoparticle, and the $[\mathrm{TFPB}]^{-}$ ions are free to dissociate into the bulk.

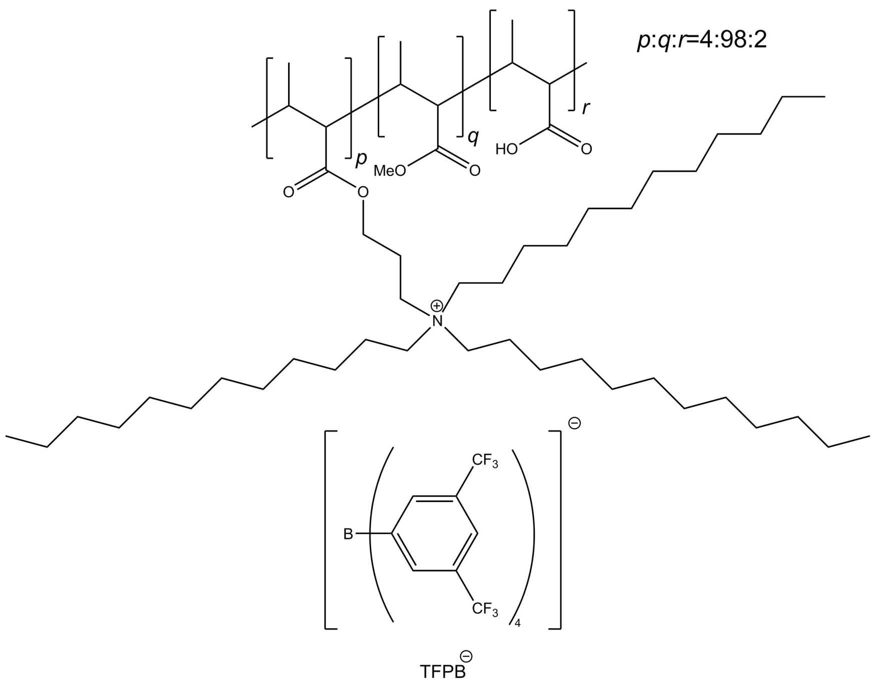

Figure 1: Schematic molecular structure of polymeric NP3 nanoparticles.

II. VARIATION OF MOBILITY WITH ADDED ELECTROLYTE

The effect of the concentration of the surfactant AOT on the packing-fraction dependent electrophoretic mobility $\mu_{\mathrm{red}}(\eta)$, measured in dispersions of negatively-charged NP1 nanoparticles, is illustrated in Figure 2. Adding aerosol-OT reverse micelles has two effects: (a) we increase the (negative) scaled particle potential Φ_{s} and, (b) by adding more ions to the dispersion we screen the electrostatic interactions between particles and reduce the dependence of the electrophoretic mobility on the nanoparticle packing fraction η. These trends are apparent from a quick comparison between the mobilities (represented by the circles) measured for $C_{\text{AOT}} = 5\,\text{mmol}\,\text{dm}^{-3}$ (shown in Figure 2(a)) and the data recorded at $C_{\text{AOT}} = 250\,\text{mmol}\,\text{dm}^{-3}$ (shown in Figure 2(d)). The Kuwabara cell model and a constant potential (CP) boundary condition reproduces these trends very well, as shown by the solid lines in Figure 2.

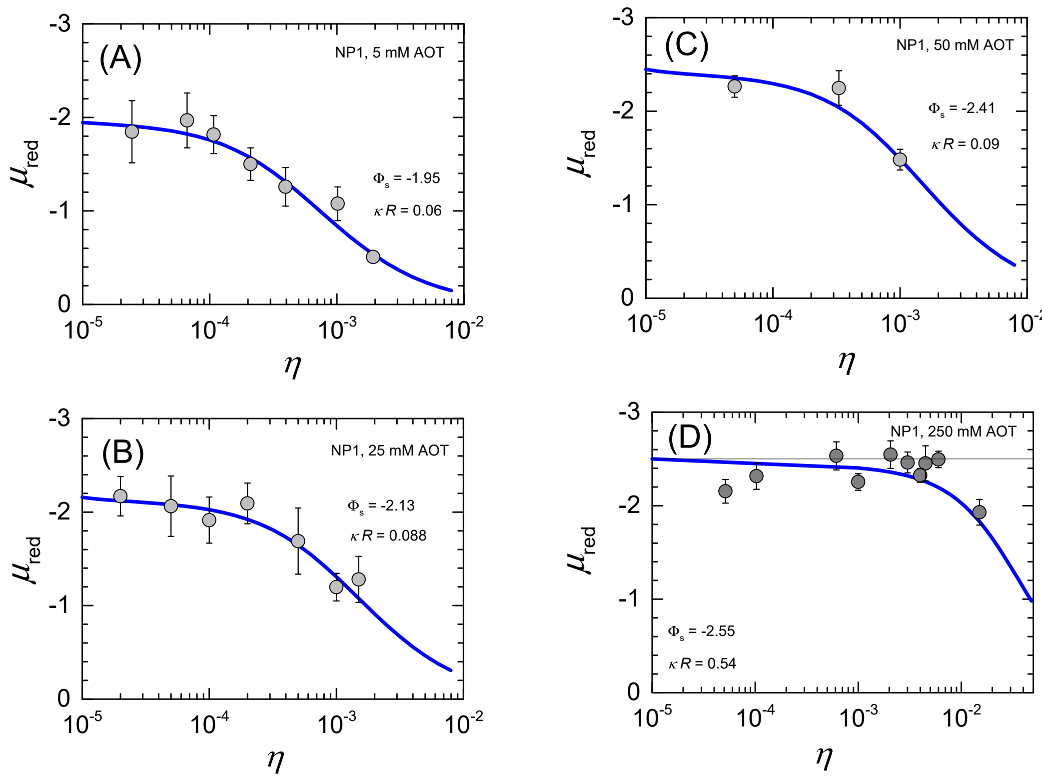

Figure 2: The reduced electrophoretic mobility μ_{red} as a function of volume fraction in dispersions of NP1 nanoparticles at (a) $C_{\text{AOT}} = 5\,\text{mmol}\,\text{dm}^{-3}$; (b) $C_{\text{AOT}} = 25\,\text{mmol}\,\text{dm}^{-3}$; (c) $C_{\text{AOT}} = 50\,\text{mmol}\,\text{dm}^{-3}$; and (d) $C_{\text{AOT}} = 250\,\text{mmol}\,\text{dm}^{-3}$. The solid lines are mobilities calculated using a Kuwabara cell model assuming a constant potential (CP) boundary condition at the surface of the particle. The fitted surface potentials Φ_s and screening parameters κR are reproduced in Table II of the paper.